# CHAPTER 25

## PROJECT IMPLEMENTATION

# CHAPTER 25

# PROJECT IMPLEMENTATION

## 25.1 PROJECT IMPLEMENTATION PROGRAM

### 25.1.1 Implementation Program

The following improvement schemes for the bridges requiring very urgent or urgent improvement works were recommended through the in-depth survey, technical judgment and comparative study on improvement alternatives:

- Ayala Bridge : Strengthening
- Jones Bridge : Major Scale Rehabilitation
- Quezon Bridge : Medium Scale Rehabilitation
- Lambingan Bridge : Medium Scale Rehabilitation
- Guadalupe Bridge (Both Sides) : Medium Scale Rehabilitation
- Vargas Bridge (Upstream Side) : Large Scale Rehabilitation

In addition to six (6) bridges above, the Second Ayala Bridge is recommended to be constructed so as to complement the traffic function of the Ayala Bridge and Quezon Bridge.

The definition of rehabilitation scale was determined individually based on the damage scale of each bridge.

**Time Frame**

- Commencement : Middle of 2004
- Completion : End of 2010

**Technical Urgency**

- The bridges having a load factor of less than 1.0 at both inventory level and operating level are given the highest priority of urgency: Ayala Bridge, Jones Bridge and Guadalupe Bridge.
- The Second Ayala Bridge is given the lowest priority of urgency; because its construction is to complement the traffic function of adjacent bridges and not for structural safety.

**Balanced Annual Expenditure**

- The implementation is to be scheduled to avoid concentration of annual expenditure for the project.

### 25.1.2 Outline of the Project

The scope of works for each bridge are outlined and presented in **Table 25.1.2-1** below:

Table 25.1.2-1 Scope of Works

| Bridge Name | Scope of Works | Remarks |
|---|---|---|
| Ayala Bridge | • Replacement of all steel lower chords with new ones<br>• Replacement of RC deck slab floor system with steel plate deck floor system<br>• Replacement of bearing shoes<br>• Strengthening of two abutments and one pier<br>• Replacement of timber piles with steel tubular piles<br>• Replacement of pavement at approach roads<br>• Replacement of pavement at intersection<br>• Widening of 1.0m sidewalk width | Strengthening |
| Second-Ayala Bridge | • Clearing / Demolition of structures along road alignment.<br>• Construction of Abutments and Retaining Walls.<br>• Earthworks / Embankment<br>• Pavement Works.<br>• Construction of Temporary Cofferdams.<br>• Construction of Bored Piles.<br>• Construction of Pile caps.<br>• Construction of Pier Walls and Pier Heads.<br>• Construction of Superstructure by Balanced Cantilever Method.<br>• Construction of Railings and Median.<br>• Installation of Expansion Joints and Drainage Accessories.<br>• Asphalt pavement works.<br>• Removal of Temporary Cofferdams.<br>• Removal of Balance Cantilever Traveler Formworks. | New Bridge Construction |
| Jones Bridge | • Demolition deck slab, sidewalk and railings at each side<br>• Installation of additional girders and bearing shoes at each side of the bridge adjacent the exterior girders<br>• Repair existing exterior girders and reinstall<br>• Construction of new deck slab, sidewalk and railings<br>• Improvement of road intersections<br>• Cleaning and painting of corroded steel members<br>• Installation of new expansion joints<br>• Repair of cracks on existing deck slab, piers and abutments | Rehabilitation |
| Quezon Bridge | • Cutting and Replacement of corroded joint connections at floor system<br>• Installation of new expansion joints at each abutment<br>• Installation of water tight sealant between vertical hangers and deck slab<br>• Removal and reconstruction of deck slab near abutments<br>• Replacement of corroded stringers<br>• Cleaning and painting of corroded steel members | Rehabilitation |
| Lambingan Bridge | • Installation of P/S slanted cables at Gerber Hinge parts<br>• Demolition and reconstruction of deck slab and diaphragm at Gerber Hinge portions<br>• Installation of P/S cables along diaphragm at Gerber Hinge parts<br>• Installation of Carbon Fiber Reinforcement on P/S Girders at top of pier portions<br>• Repair of cracks, honeycombs and spalling on existing deck slab<br>• Construction of uplift measure at abutments | Rehabilitation |
| Guadalupe Bridge | • Installation of P/S slanted cables at Gerber Hinge parts<br>• Demolition and reconstruction of deck slab and diaphragm at Gerber Hinge portions<br>• Installation of P/S cables along diaphragm at Gerber Hinge parts<br>• Repair of cracks, honeycombs and spalling on existing deck slab<br>• Installation of additional bearing pads at diaphragm | Rehabilitation |
| Vargas Bridge | • Installation of P/S slanted cables at Gerber Hinge parts<br>• Demolition and reconstruction of deck slab and diaphragm at Gerber Hinge portions<br>• Installation of External P/S Tendons along girders<br>• Repair of cracks, honeycombs and spalling on existing deck slab | Rehabilitation |

### 25.1.3 Project Cost

The project costs are tabulated and presented below:

Table 25.1.3-1 Project Cost

| Bridge Name | Items | Amount |
|---|---|---|
| Ayala Bridge | Construction Cost | 1,071.3 |
| | Engineering Cost | 122.60 |
| | Land Acquisition Cost | 63.00 |
| | Total | 1,256.90 |
| Second Ayala Bridge | Construction Cost | 647.62 |
| | Engineering Cost | 103.70 |
| | Land Acquisition Cost | 190.00 |
| | Total | 941.31 |
| Jones Bridge | Construction Cost | 164.10 |
| | Engineering Cost | 21.30 |
| | Land Acquisition Cost | - |
| | Total | 185.40 |
| Quezon Bridge | Construction Cost | 119.60 |
| | Engineering Cost | 15.60 |
| | Land Acquisition Cost | - |
| | Total | 135.20 |
| Lambingan Bridge | Construction Cost | 52.40 |
| | Engineering Cost | 6.80 |
| | Land Acquisition Cost | - |
| | Total | 59.20 |
| Guadalupe Bridge | Construction Cost | 20.50 |
| | Engineering Cost | 2.70 |
| | Land Acquisition Cost | - |
| | Total | 23.10 |
| Vargas Bridge | Construction Cost | 26.10 |
| | Engineering Cost | 3.40 |
| | Land Acquisition Cost | - |
| | Total | 29.50 |
| **GRAND TOTAL** | | **2,630.62** |

### 25.1.4 Overall Implementation Schedule

Within the calendar of implementation schedule, the biggest annual fund requirement will be on the year 2006 and 2007 with ₱752.75 and ₱881.23 million pesos respectively.

The proposed implementation schedule for each bridge is summarized as follows:

**(1) Ayala Bridge**

Project starts in the middle of year 2004 and will be completed by the end of year 2007.

**(2) Second Ayala Bridge**

Project starts at the beginning of year 2007 and will be completed by the end of year 2010.

**(3) Jones Bridge**

Project starts in the middle of year 2004 and will be completed by the end of year 2006.

**(4) Quezon Bridge**

Project starts in the middle of year 2005 and will be completed by the end of year 2007.

**(5) Lambingan Bridge**

Project starts at the beginning of year 2006 and will be completed by the end of year 2007.

**(6) Guadalupe Bridge**

Project starts in the middle of year 2004 and will be completed by the end of year 2006.

**(7) Vargas Bridge**

Project starts at the beginning of year 2006 and will be completed by the end of year 2007.

The implementation schedule and annual fund requirements for 7 bridges are presented in **Table 25.1.4-1.**

## Table 25.1.4-1 Implementation Schedule and Annual Requirement

Unit: million Pesos

| | | | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | SUB-TOTAL | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Package I | Ayala Bridge | Detailed Design | 20.5 | 20.4 | | | | | | 40.9 | 1,256.9 |
| | | ROW Acquisition | | 63.0 | | | | | | 63.0 | |
| | | Tender | | | | | | | | - | |
| | | Construction | | | 535.7 | 535.6 | | | | 1,071.3 | |
| | | Const. Supervision | | | 40.9 | 40.8 | | | | 81.7 | |
| | Jones Bridge (ROW Acquisition not required) | Detailed Design | 8.2 | | | | | | | 8.20 | 185.40 |
| | | Tender | | | | | | | | - | |
| | | Construction | | 54.70 | 109.4 | | | | | 164.10 | |
| | | Const. Supervision | | 4.37 | 8.73 | | | | | 13.10 | |
| | Guadalupe Bridge (ROW Acquisition not required) | Detailed Design | 1.0 | | | | | | | 1.0 | 23.10 |
| | | Tender | | | | | | | | - | |
| | | Construction | | 10.25 | 10.25 | | | | | 20.50 | |
| | | Const. Supervision | | 0.80 | 0.80 | | | | | 1.60 | |
| | **Sub-Total** | | **29.70** | **153.52** | **705.75** | **576.40** | - | - | - | **1,465.40** | |
| Package II | Quezon Bridge (ROW Acquisition not required) | Detailed Design | | 6.0 | | | | | | 6.0 | 135.20 |
| | | Tender | | | | | | | | - | |
| | | Construction | | | 39.87 | 79.73 | | | | 119.60 | |
| | | Const. Supervision | | | 3.20 | 6.40 | | | | 9.60 | |
| | Lambingan Bridge (ROW Acquisition not required) | Detailed Design | | | 2.60 | | | | | 2.60 | 59.20 |
| | | Tender | | | | | | | | - | |
| | | Construction | | | | 52.4 | | | | 52.4 | |
| | | Const. Supervision | | | | 4.20 | | | | 4.20 | |
| | Vargas Bridge (ROW Acquisition not required) | Detailed Design | | | 1.3 | | | | | 1.30 | 29.50 |
| | | Tender | | | | | | | | - | |
| | | Construction | | | | 26.10 | | | | 26.10 | |
| | | Const. Supervision | | | | 2.10 | | | | 2.10 | |
| | **Sub-Total** | | - | **6.00** | **46.97** | **170.93** | - | - | - | **223.90** | |
| Package III | Second Ayala Bridge | Detailed Design | | | | 38.9 | | | | 38.9 | 941.32 |
| | | ROW Acquisition | | | | 95.0 | 95.0 | | | 190.0 | |
| | | Tender | | | | | | | | - | |
| | | Construction | | | | | | 323.81 | 323.81 | 647.62 | |
| | | Const. Supervision | | | | | | 32.4 | 32.4 | 64.8 | |
| | **Sub-Total** | | - | - | - | **133.90** | **95.0** | **356.21** | **356.21** | **941.32** | |
| **GRAND TOTAL** | | | **29.7** | **159.52** | **752.75** | **881.23** | **95.0** | **356.21** | **356.21** | **2,630.62** | |

## 25.2 FINANCIAL ANALYSIS AND FUNDING PREPARATION

### (1) Procedure for Funding Preparation

The procedure to estimate possible funding for bridge construction and rehabilitation is shown in **Figure 25.2-1**.

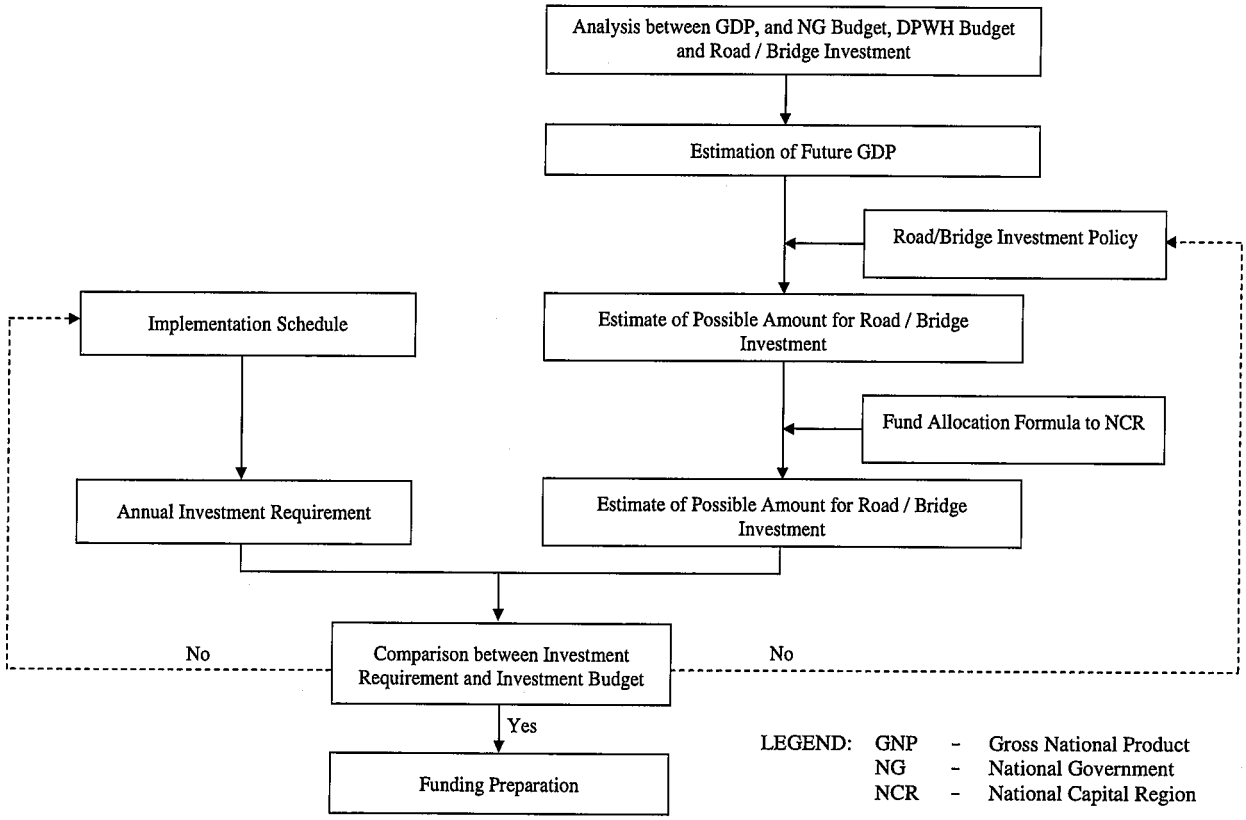



Figure 25.2-1 Procedure for Financial Analysis and Funding Preparation

### (2) Analysis Estimate of Possible Funding Preparation

**Relation between GNP and Road / Bridget Investment**

Past trend of the National Government (NG) Budget, the DPWH Budget and the road / bridge budget in relation with GNP was analyzed and shown in **Tables 25.2-1** and **25.2-2** and **Figure 25.2-2**. Major figures of past trend are summarized as follows:

Table 25.2-1 Summary of GNP and Road / Bridge Investment

| | Average | Minimum | Maximum |
|---|---|---|---|
| Share of NG Budget to GNP | 19.5% (1995-2003) | 13.1 % (2003) | 19.8 % (1995) |
| Share of DPWH Budget to GNP | 1.78 % (1995 – 2003) | 1.14 % (2002) | 2.21 % (1998) |
| Share of Road / Bridge Investment to GNP | 0.76 % (1995 – 2003) | 0.38 % (2002) | 1.06 % (1998) |
| Share of Road / Bridge Maintenance Budget to GNP | 0.14 % (1995 -2003) | 0.10 % (2002) | 0.17 % (1995) |

Table 25.2-2 Relation between GNP, NG Budget, DPWH Budget, Road/Bridge Investment and Maintenance Budget by Year

| | | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|
| GNP (Current Price, Million Pesos) | Amount (Billion Pesos) | 1,958.6 | 2,261.3 | 2,528.3 | 2,802.2 | 3,136.2 | 3,496.9 | 3,853.3 | 4,223.6 | 4,647.9 |
| | Growth Rate (Nominal) (%) | - | 15.5 | 11.8 | 10.8 | 11.9 | 11.5 | 10.2 | 9.6 | 10.0 |
| National Government Budget | Amount (Billion Pesos) | 387.4 | 394.9 | 433.8 | 546.7 | 585.1 | 665.1 | 665.1 | 575.1 | 609.6 |
| | % Share to GNP | 19.8 | 17.5 | 17.2 | 19.5 | 18.7 | 19.0 | 17.3 | 13.6 | 13.1 |
| DPWH Annual Appropriation | Amount (Billion Pesos) | 35.93 | 40.37 | 53.82 | 61.82 | 37.72 | 52.37 | 52.37 | 47.99 | 52.95 |
| | % Share to NG Budget | 9.3 | 10.2 | 12.4 | 11.3 | 6.4 | 7.9 | 7.9 | 8.3 | 8.7 |
| | % Share to GNP | 1.83 | 1.79 | 2.13 | 2.21 | 1.20 | 1.50 | 1.36 | 1.14 | 1.14 |
| Road/Bridge Investment | Amount (Billion Pesos) | 11.79 | 15.43 | 22.72 | 29.73 | 24.22 | 21.47 | 21.47 | 15.98 | 25.86 |
| | % Share to DPWH Budget | 32.80 | 38.20 | 42.20 | 48.10 | 64.20 | 41.00 | 41.00 | 33.30 | 48.80 |
| | % Share to GNP | 0.60 | 0.68 | 0.90 | 1.06 | 0.77 | 0.61 | 0.56 | 0.38 | 0.56 |
| Road/Bridge Maintains | Amount (Billion Pesos) | 3.24 | 3.40 | 3.59 | 3.70 | 3.79 | 4.11 | 4.09 | 4.08 | 4.65 |
| | % Share to DPWH Budget | 9.02 | 8.42 | 6.67 | 5.99 | 10.05 | 7.85 | 7.81 | 8.50 | 8.78 |
| | % Share to GNP | 0.17 | 0.15 | 0.14 | 0.13 | 0.12 | 0.12 | 0.11 | 0.10 | 0.10 |

Source: 1) GNP Central Bank of Philippines
2) National Government Budget DBM
3) DPWH annual appropriation and Road and Bridge Investment: DPWH

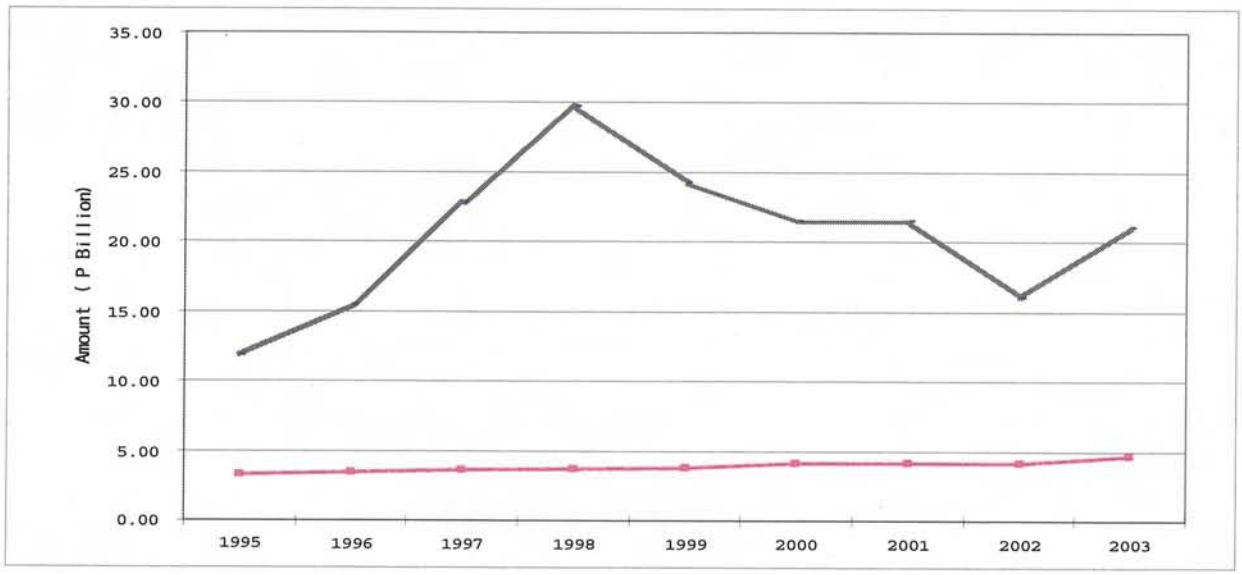



Figure 25.2-2 Past Trend of Road / Bridge Investment and Maintenance Budget

### (3) Projection for Road and Bridge Budgets between 2004 and 2010

The road bridge budget between 2004 and 2010 was projected and shown in **Table 25.2-3.** This projection was made on the basis of the following assumptions:

- GNP growth rate of high and low growth rate is based on the Medium-Term Philippine Development Plan 2001-2004 and recent GNP growth rate.

  High Growth Rate : 5.7% per annum

  Low Growth Rate : 4.5% per annum

- The road and bridge budget is assumed to increase in proportion to GNP growth rate.
- The road and bridge budget between 2004 and 2010 was estimated using the GNP and an average percentage for road/bridge investment (0.60%) and that for road/bridge maintenance budget (0.17%) to the GNP between 1995 and 2003.

Table 25.2-3 Projected Road Bridge Budget Between 2004 and 2020

Unit: Billion Pesos

| | | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|
| GNP | High | 4,647.9 | 4,912.8 | 5,133.8 | 5,365.3 | 5,606.3 | 5,859.0 | 6,122.1 | 6398.0 |
| | Low | | 4,857.0 | 5,076.0 | 5,304.0 | 5,543.0 | 5,792.0 | 6,053.0 | 6325.0 |
| Road/Bridge Budget | High | 41.83 | 44.22 | 46.20 | 48.29 | 50.46 | 52.73 | 55.10 | 57.58 |
| | Low | | 43.71 | 45.68 | 47.74 | 49.89 | 52.13 | 54.48 | 56.93 |
| Road/Bridge Investment | High | 35.32 | 37.34 | 39.02 | 40.78 | 42.61 | 44.53 | 46.53 | 48.62 |
| | Low | | 36.91 | 38.58 | 40.31 | 42.13 | 44.02 | 46.00 | 48.07 |
| Road/Bridge Maintenance | High | 6.51 | 6.88 | 7.19 | 7.51 | 7.85 | 8.20 | 8.57 | 8.96 |
| | Low | | 6.80 | 7.11 | 7.43 | 7.76 | 8.11 | 8.47 | 8.86 |

### (4) Comparison between Investment Requirement and Investment Budget

**Table 25.2-4** shows the comparison of the road and bridge investment budget and the investment requirement for improvement of the Study Bridges. Even if the low growth rate scenario is taken into account, percent share to total investment budget is only 2.1% in 2007 as a maximum year. Therefore, the budget for implementing the improvement of the Study Bridges can be secured.

Table 25.2-4 Comparison between Road and Bridge Budget and Annual Investment Requirement

| Year | Road and Bridge Investment Budget (Million Pesos) | Annual Investment Requirement (Million Pesos) | % |
|---|---|---|---|
| 2004 | 36,913.20 | 29.70 | 0.1 |
| 2005 | 38,577.60 | 159.52 | 0.4 |
| 2006 | 40,310.40 | 752.75 | 1.9 |
| 2007 | 42,126.80 | 881.23 | 2.1 |
| 2008 | 44,019.20 | 95.00 | 0.2 |
| 2009 | 46,002.80 | 356.21 | 0.8 |
| 2010 | 48,070.00 | 356.21 | 0.7 |

# CHAPTER 26

## CONCLUSIONS AND RECOMMENDATIONS

# CHAPTER 26

# CONCLUSIONS AND RECOMMENDATIONS

## 26.1 CONCLUSION

### 26.1.1 Justification of Project

The Project implementation is justified based on the findings of survey and the proposed improvement measures.

**(1) Findings**

(a) Most bridges are seriously and heavily deteriorated because of old age and increasing truck axle loads, with stopgap measures owing to low recognition of the importance of routine maintenance, timely rehabilitation and insufficient budget.

(b) The existing bridges represent major traffic bottlenecks due to their insufficient structural soundness, limited traffic capacity and insufficient number of bridges over Pasig and Marikina Rivers.

(c) The vessel collisions seriously damaged the superstructure and substructure of study bridges because of oversized or large vessels, insufficient navigation clearance and back of protection facilities.

To cope with such problems, rehabilitation, strengthening and new construction are proposed with the recommendation on the importance of routine maintenance, depending on the present condition of bridges.

**(2) Proposed Improvement Measures**

(a) Among 17 bridges surveyed in the Study, six (6) bridges are assessed to require urgent improvement works in terms of the structural soundness:

Out of these six (6) bridges, particularly, three (3) bridges are in very serious condition requiring very urgent measures while the other three (3) are in serious condition.

*Very Serious Condition; Very Urgent*

| Bridge Name | Major Damages | Major Improvement |
|---|---|---|
| Ayala Bridge | • Heavily corroded floor system<br>• Ruptured stringers and section loss of lower chords. | • Replacement of lower chord and floor system.<br>• Strengthening of Abutment and Pier. |
| Jones Bridge | • Ruptured and deformed exterior girders. | • Provision of additional girder with new bearing shoes.<br>• Replacement of ruptured sway bracing. |
| Guadalupe Bridge | • Cracks at gerber hinge parts of girder | • Rehabilitation of gerber hinge portion with slanted P/S cables.<br>• Installation of transverse P/S cables at diaphragm. |

*Serious Condition; Urgent*

| Bridge Name | Major Damages | Major Improvement |
|---|---|---|
| Quezon Bridge | • Heavily corroded joint connections of floor deck.<br>• Poor treatment of expansion joint. | • Replacement of Gusset Plates.<br>• Replacement of corroded section of floor beam, longitudinal tie beam and vertical members.<br>• Replace expansion joint |
| Lambingan Bridge | • Cracks at gerber hinge parts and on pier.<br>• Insufficient uplift devices. | • Installation of CFRP vertically at web near hinge and longitudinally at top of girder over pier support.<br>• Additional concrete block doweled to abutment. |
| Vargas Bridge | • Cracks at gerber hinge parts and on pier and large vertical deformation. | • Installation of CFRP at top of girder and horizontally at gerber hinge.<br>• Installation of external cables along girder. |

*New Construction; Traffic Capacity Improvement*

| Bridge Name | Major Damages | Major Improvement |
|---|---|---|
| Second Ayala Bridge | New Construction | New construction |

(b) As for Ayala Bridge improvement, the strengthening of existing structure (replacement of lower chord and floor system) was adopted in lieu of re-construction in due consideration of the historical heritage of the existing Ayala Bridge which is declared as a historical structure to be preserved by the National Historical Institute.

(c) The Second Ayala Bridge is proposed, through a series of consultation and discussion with agencies concerned and will be constructed between the Ayala Bridge and Quezon Bridge. The Second Ayala Bridge is expected to play a role as a complement to the traffic function of the Ayala Bridge and improve the traffic flow in the vicinity area.

### 26.1.2 Viability of the Project

The proposed improvement measures were evaluated from various aspects and scenarios and concluded to be feasible as follows.

#### (1) Technical Aspects

The proposed improvement measures are technically feasible with careful consideration of the following:

- All bridge improvement works require a sophisticated and state-of-the-art technology, especially, for the Ayala Bridge and Quezon Bridge.
- Reliable contractors with similar project experiences and high technical capability should only be the ones allowed to undertake the project.
- The Second Ayala approach bridge construction can be conducted by usual construction method used in the Philippines in accordance with the DPWH Standard Specifications. All equipment and materials are obtained in the Philippines.

### (2) Economic and Financial Aspects

- Sufficient economic return is expected for each improvement project and the Second Ayala Bridge construction is proven by economic evaluation to require an early implementation of the project.
- The project can be implemented within reasonable budgetary framework of the DPWH, in accordance with the proposed implementation schedule.

### (3) Environmental Impact Aspects

- From the characteristics of the improvement works of existing bridges, negative impact during implementation are expected to be very minimal in terms of the social impact and the land acquisition aspects.
- The Second Ayala Bridge requires land acquisition and affects several houses and families; 10 houses and 3 families will be affected. However, in case of the Ayala Bridge, 5 houses and 4 families will be affected.

### (4) Impact on Area Development

- The improvement of existing bridges as life line transport facilities is expected to promote the socio-economic activities in Metro Manila.
- The Second Ayala Bridge project is to be in harmony with Manila City re-development plan.

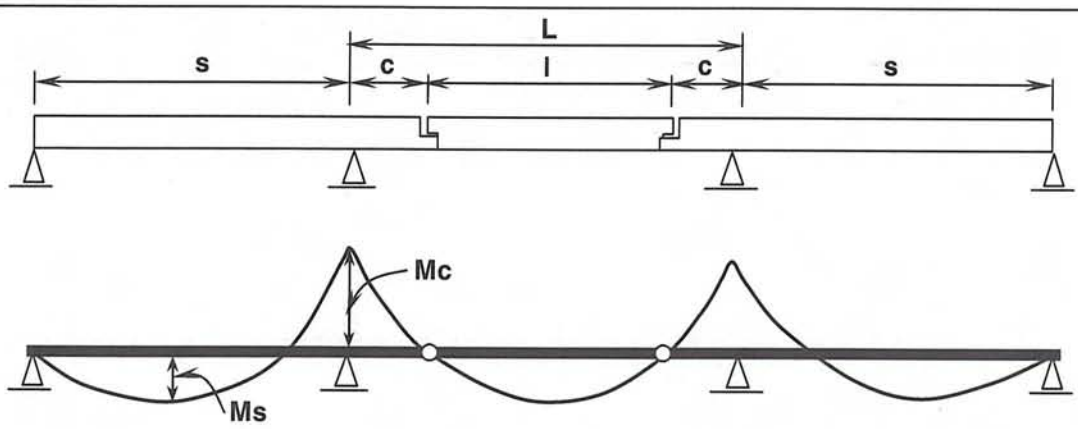
## 26.1.3 Technical Observations

### (1) Features of Major Damages

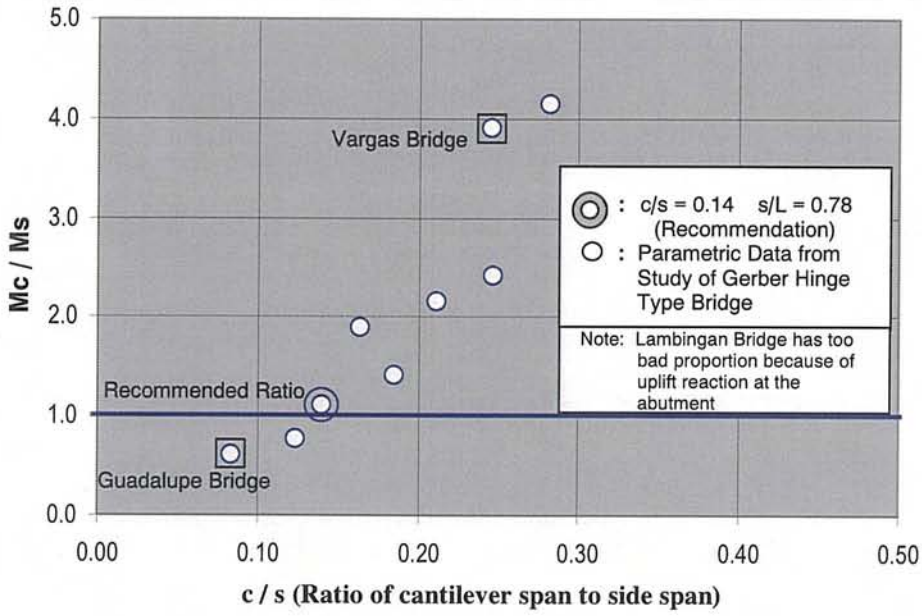
- Most of the bridges under the Study have local damages such as concrete cracks, steel corrosion, reinforcing bar exposure and corrosion.
- Old bridges, particularly, steel bridges are assessed relatively more sound compared to concrete bridges.
- Defects on concrete bridges could be traced to construction quality and workmanship on site which could not follow the design requirement.
- With steel members/girders being fabricated in the fabrication yard, the quality of workmanship is properly controlled resulting to a more durable structure.
- Lack of daily and periodic maintenance, including cleaning, painting and protection from water, lead to the deterioration of steel members.
- Heavy damages of substructures are usually caused by vessel collision.

### (2) Causes of Major Damages

- Vessel collision with girders: Insufficient vertical clearance
  - Ayala Bridge and Jones Bridge
- Serious cracks at gerber hinge parts and girders on peir-top: Bridge planning and design (Refer to **Figure 26.1.2-1**)
  - Lambingan Bridge, Guadalupe Bridge and Vargas Bridge
- Vertical deformation of girders: Bridge planning and construction quality.
  - Lambingan Bridge and Vargas Bridge
- Uplift reaction at abutments: Bridge planning
  - Lambingan Bridge
- Heavy corrosion of steel joint connections: Water leaking from the deck slab and poor maintenance of expansion joints.
  - Ayala Bridge and Quezon Bridge
- Heavy corrosion of bearings on pier and abutment: Water leaking.
  - Ayala Bridge, Jones Bridge and Quezon Bridge
- Cracks on deck slab: Fatigue stress associated with the increase of traffic axle load and volume.




s = 30.50 m ~ 40.50 m
c = 5.00 m ~ 10.00 m
Mc : Maximum moment of a girder on top of the pier
Ms : Maximum moment of a girder at the center of sidespan




Calculation of Preferable Overhang Length of Gerber Hinge Type Bridge (AASHTO Girders)

- The graph above is prepared for the Gerber Hinge Type bridge to search the proportion which has balanced moment ratio between maximum moment of a girder on pier top ( Mc ) and the maximum moment of a girder at the center of a side span ( Ms ) on AASHTO Girders.
- According to the graph, the most preferable proportion c / s ratio is about 0.14. Engineers shall consider this proportion in the bridge planning.
- The proportion of the Lambingan Bridge and Vargas Bridge is far from the preferable proportion which suggests the occurrence of cracks of girders on pier top of these bridges.
- Regarding cracks at Gerber Hinge parts, these causes are revealed by FEM Analysis in Section 22.1.5, Section 23.1.5 and Section 24.1.5 for Lambingan Bridge, Guadalupe Bridge and Vargas Bridge respectively.

| Bridge Name | Preferable Overhang Length | Actual Condition | | Judgment of Actual Overhang Length |
|---|---|---|---|---|
| | | Actual Overhang Length | Side Span Length | |
| Lambingan Bridge | 2.60 m (c/s=0.14) | 7.50 m (c/s = 0.408) | 18.50 m | Too long |
| Guadalupe Bridge | 5.00 m (c/s = 0.14) | 3.00 m (c/s = 0.084) | 30.50 m | Too short |
| Vargas Bridge | 4.30 m (c/s = 0.14) | 7.50 m (c/s = 0.256) | 35.50 m | Too long |

Figure 26.1.2-1 Study on Bridge Planning for Gerber Hinge Type

## 26.2 RECOMMENDATIONS

### (1) Early Implementation

The proposed improvement project is in very urgent need and should be implemented at the earliest possible time, with the precautious preparation of the followings:

- Securing Environmental Compliance Certificate (ECC)

  The ECC of the project shall be cleared, preferably before the start of detailed design in accordance with the guidelines of the financial lending institution.

- R.O.W. Acquisition

  The activities on R.O.W acquisition shall commence based on the findings of the Feasibility Study, and the pre-agreement with the stakeholder shall be secured before the start of detailed design.

- Resettlement Plan for Project-affected People

  The resettlement plan for project-affected people shall be prepared based on the findings of the Feasibility Study, and approved by agencies concerned before the start of the detailed design.

- Fund Preparation

  Judging from the magnitude of the projects, foreign assistance for funding will be needed, thus necessary arrangement and negotiation with a lending institution should be made at a proper timing.

### (2) Temporary Implementation of Vehicle Load Limit Regulation for the Ayala Bridge

Although the very early implementation of improvement of the Ayala Bridge is required, the possible delay may be anticipated because of unforeseen reasons.

In this instance, the vehicle load limit regulation shall be temporarily implemented in order to secure the safety of the bridge users, as proposed in the Feasibility Study.

### (3) Monitoring the Bridges Requiring the Very Urgent Improvement Works

It is strongly recommended for the following bridges that the progress of damages or deformation should be monitored and take necessary countermeasures if the progress of damages is found;

- Ayala Bridge : in addition to adopting certain load limit, abnormal deflection or vibration during vehicles' passing
- Jones Bridge : the progress of cracks of steel members and new evidence of vessel collisions
- Guadalupe Bridge : the progress of cracks width at gerber hinge parts

### (4) Implementation of Second Ayala Bridge

#### (a) Development Control within Road R.O.W. along the Proposed Route of the Second Ayala Bridge

Based on the recommendation of the Feasibility Study, the road R.O.W. along the proposed route shall be acquired at the proper time, and any development within the road R.O.W. shall be strictly prohibited.

It is recommended that authorities concerned shall take such activities and promulgate the necessary ordinance.

#### (b) A Study on Future Extension of the Route

The future extension of the Second Ayala Bridge route shall be studied in order to mitigate the traffic congestion in extensive areas.

### (5) Dissemination of Established Technology as Sustainable Human Capacity Building Program.

The highly engineering technique on assessment of structural soundness of existing bridges, damage diagnosis, load-rating analysis, etc., was established and compiled in the Manual under the Feasibility Study.

The low recognition of the importance on such highly engineering technique leads to negligence of routine maintenance and timely rehabilitation which leads to huge rehabilitation/improvement cost.

It is highly recommended that the dissemination of such technology shall be pursued as a program of sustainable human capacity building.